

What is claimed is:

1. A method of processing at least first and second images of an image flow of an object to determine a relative displacement of elements of the image flow over a predetermined time interval, the method comprising:

(a) recording a first array of pixel values associated with the first image of the image flow;

(b) recording a second array of pixel values associated with the second image of the image flow;

(c) defining a first plurality of interrogation regions on each of the first and second arrays of pixel values of the image flow and each of the first plurality of interrogation regions including a first minimal pixel resolution;

(d) processing a first interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values to provide a first correlation plane including a first plurality of signal values;

(e) detecting a first predetermined signal value from the first plurality of signal values associated with the first correlation plane; and

(f) determining a direction and magnitude of the first predetermined signal value located on the first correlation plane which represents the relative displacement of elements of the image flow over the predetermined time interval.

2. The method of claim 1, wherein if the direction and magnitude of the first predetermined signal value is unresolved, the method further includes:

(g) grouping predetermined ones of the first plurality of interrogation regions located on each of the first and second arrays of pixel values of the image flow to form a second plurality of interrogation regions on each of the first and second arrays of pixel values of the image flow and each of the second plurality of interrogation regions including a second minimal pixel resolution greater than the first minimal pixel resolution.

3. The method of claim 2, further including:

(h) processing a first interrogation region from each of the second plurality of interrogation regions located on each of the first and second arrays of pixel values to provide a second correlation plane including a second plurality of signal values.

4. The method of claim 3, further including:

(i) detecting a second predetermined signal value from the first plurality of signal values associated with the second correlation plane.

5. The method of claim 4, further including:

(j) determining a direction and magnitude of the second predetermined signal value located on the second correlation plane which represents the relative displacement of elements of the image flow over the predetermined time interval.

6. The method of claim 5, wherein if the direction and magnitude of the second predetermined signal value is unresolved, the method further includes:

(k) grouping predetermined ones of the second plurality of interrogation regions located on each of the first and second arrays of pixel values of the image flow to form a third plurality of interrogation regions on each of the first and second arrays of pixel values of the image flow and each of the third plurality of interrogation regions including a third minimal pixel resolution greater than the second minimal pixel resolution.

7. The method of claim 6, further including:

(l) processing a third interrogation region from each of the third plurality of interrogation regions located on each of the first and second arrays of pixel values to provide a third correlation plane including a third plurality of signal values.

8. The method of claim 7, further including:

(m) detecting a third predetermined signal value from the third plurality of signal values associated with the third correlation plane.

9. The method of claim 8, further including:

(n) determining a direction and magnitude of the third predetermined signal value located on the third correlation plane which represents the relative displacement of elements of the image flow over the predetermined time interval.

10. The method of claim 1, wherein processing further includes:

interacting the first interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values with a discrete correlation function to provide the first correlation plane including the first plurality of signal values.

11. The method of claim 3, wherein processing further includes:

processing at least one other interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values to provide at least one other correlation plane including a plurality of signal values; and

combining the first correlation plane and the at least one other correlation plane to provide the second correlation plane.

12. The method of claim 7, wherein processing further includes:

processing at least one other interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values to provide at least one other correlation plane including a plurality of signal values; and

combining the second correlation plane and the at least one other correlation plane to provide the third correlation plane.

13. The method of claim 1, further including:

validating the first predetermined signal value located on the first correlation plane; and

declaring that the relative displacement of elements of the image flow is locally complete if the direction and magnitude of the first predetermined signal value is validated.

14. The method of claim 5, further including:

validating the second predetermined signal value located on the second correlation plane; and

declaring that the relative displacement of elements of the image flow is locally complete if the direction and magnitude of the second predetermined signal value is validated.

15. The method of claim 3, further including:

validating the third predetermined signal value located on the third correlation plane; and

declaring that the relative displacement of elements of the image flow is locally complete if the direction and magnitude of the third predetermined signal value is validated.

16. The method of claim 2, wherein grouping further includes grouping at least two interrogation regions of the first plurality of interrogation regions of each of the first and second arrays of pixel values to form each interrogation region of the second plurality of interrogation regions respectively located on each of the first and second arrays of pixel values.

17. The method according to claim 6, wherein grouping further includes grouping at least two interrogation regions of the second plurality of interrogation regions of each of the first and second arrays of pixel values to form each interrogation region of the third plurality of interrogation regions respectively located on each of the first and second arrays of pixel values.

18. The method according to claim 1, further including:  
    associating at least one pixel value with each of the interrogation regions of the first plurality of interrogation regions defined on each of the first and second arrays of pixel values.
19. The method according to claim 1, wherein detecting the first predetermined signal value from the first plurality of signal values associated with the first correlation plane includes detecting a first signal value based on a result of oversampling the image flow.
20. The method according to claim 4, wherein detecting the second predetermined signal value from the second plurality of signal values associated with the second correlation plane includes detecting a second signal value based on a result of oversampling the image flow.
21. The method according to claim 8, wherein detecting the third predetermined signal value from the third plurality of signal values associated with the third correlation plane includes detecting a third signal value based on a result of oversampling the image flow.